

WORKING WITH SCIENTIFIC EQUATIONS AND FORMULAS**Rearranging Algebraic Equations**

When you first learn about an equation, it is usually shown in the following way. A symbol you haven't seen before is on the left of the equation. Symbols you've studied are on the right side of the equation. The value of the quantity that the unfamiliar symbol represents can be found by performing mathematical operations on the familiar quantities. The equation for density is shown below as an example.

A diagram showing the equation $D = \frac{m}{V}$. A box on the left labeled "Density, a new idea" has a line pointing to the letter D . A box on the right labeled "Mass and volume from Chapter 1" has a line pointing to the fraction $\frac{m}{V}$.

If you wish to calculate density, just put the known values for mass and volume into the equation.

What do you do, however, if you know the density of a substance as well as its volume, and you need to find the mass of the substance? You start with the same equation but rearrange it. That way the values that you know—density and volume—are both on the right side of the equation, and the unknown variable—mass—is by itself on the left side, as shown below.

Math Skills

Rearrange the equation for density to solve for mass.

Solution

1. Write the equation as it is usually given.

$$D = \frac{m}{V}$$

2. Because mass is the unknown quantity, flip the equation to put mass on the left.

$$\frac{m}{V} = D$$

3. The equation will still be true if you multiply both sides of the equation by the same amount. Multiply both sides by volume (V). This will cancel out volume on the left side, leaving mass alone on the left.

$$\frac{\cancel{m}}{\cancel{V}} \times \cancel{V} = D \times V = DV$$

4. The equation has now been rearranged as needed.

$$m = DV$$

What if you know the density and the mass of a substance and you need to find its volume? The density equation can also be rearranged to solve for volume, as shown in the next sample problem.

WORKING WITH SCIENTIFIC EQUATIONS AND FORMULAS● **Rearranging Algebraic Equations** *continued***Math Skills**

Rearrange the density equation to solve for volume.

Solution

1. Write the equation as it is usually given.

$$D = \frac{m}{V}$$

2. Because the unknown quantity—volume—is in the denominator, multiply both sides of the equation by volume (V). The equation will still be true, and volume will be on the left side where you want it.

$$DV = \frac{mV}{V}$$

3. Divide both sides of the equation by density (D). This will cancel out the density on the left side, leaving volume alone on the left.

$$\frac{DV}{D} = \frac{m}{D}$$

4. The equation has now been rearranged as needed.

$$V = \frac{m}{D}$$

Practice

1. Rearrange the equation for area of a rectangle ($A = l \times w$) to solve for length, l .
2. Rearrange the equation for velocity $\left(v = \frac{d}{t}\right)$ to solve for time, t .
3. Rearrange the equation for volume of a rectangular solid ($V = l \times w \times h$) to solve for width, w .
4. Rearrange the equation relating energy to specific heat capacity ($E = cm\Delta t$) to solve for change in temperature, Δt .